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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,931	04/02/2004	Takayuki Ito	03180.0362	9413

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EXAMINER	
LINDSAY JR, WALTER LEE	

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 06/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/815,931	ITO ET AL.	
	Examiner	Art Unit	
	Walter L. Lindsay, Jr.	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 12* is/are rejected.

7)☒ Claim(s) *9-11 and 13-19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/2/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to an Application filed on 4/2/2004.

Currently, claims 1-19 are pending.

Specification

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 6 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In both claims 6 and 8, it seems applicant is performing the sub-activation before the implant is implanted but after the pre-anneal. This is problematic because the pre-anneal is performed after the implantation has taken place.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-5, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (U.S. Patent No. 5,837,572 dated 11/17/1998) in view of Krivokapic et al. (U.S. Patent No. 6,512,273 dated 1/28/2003).

Gardner shows the method substantially as claimed in Figs. 1-10 and corresponding text as: forming first and second insulating gate portions (16) to be spaced from each other on a semiconductor substrate (10) (col. 6, lines 38-56), the first insulating gate portion including a first gate insulating film (16) and a first gate electrode (18a) doped with an impurity of a first conductivity type (col. 7, lines 10-23), and the second insulating gate portion including a second gate insulating film (16) and a second gate electrode (18b) doped with an impurity of a second conductivity type (col. 8, lines 56-65); selectively implanting impurity ions of the first conductivity type to the first gate electrode and a surface layer (24) of the semiconductor substrate adjacent to the first insulating gate portion (col. 7, lines 24-55); and selectively implanting impurity ions of the second conductivity type to the second gate electrode and the surface layer (56) adjacent to the second insulating gate portion (col. 8, lines 56-65) (claim 1). Gardner

teaches that an insulating film is formed on the semiconductor substrate; forming a polycrystalline conductive film doped with the impurity of the first conductivity type on the insulating film; and selectively removing the insulating film and the polycrystalline conductive film to form the first and second gate insulating films and the first and second gate electrodes (col. 6, lines 38-56) (claim 2). Gardner teaches the step of forming the first and second insulating gate portions further comprises forming first and second sidewall spacers (20a, 20b) on the semiconductor substrate, the first sidewall spacer being adjacent to the first gate insulating film and the first gate electrode, and the second sidewall spacer being adjacent to the second gate insulating film and the second gate electrode (col. 6, line 57-col. 7, line 8)(claim 3). Gardner teaches that a polycrystalline conductive film deposited made substantially of an intrinsic semiconductor on the insulating film; implanting the impurity ions of the first conductivity type at least to a region where the first gate electrode is formed in the polycrystalline conductive film; and diffusing the impurity ions of the first conductivity type into the polycrystalline conductive film (col. 7, lines 10-23) (claim 4). Gardner teaches selectively implanting the impurity ions of the first conductivity type to the first gate electrode and the surface layer adjacent to the first gate electrode; and selectively impurity ions of the first conductivity type to the surface layer and the first gate electrode, both of which are adjacent to the first sidewall spacer (col. 7, lines 10-23)(claim 5). Gardner teaches selectively implanting the impurity ions of the second conductivity type to the second gate electrode and the surface layer adjacent to the second gate electrode; and selectively impurity ions of the second conductivity type to

the surface layer and the second gate electrode, both of which are adjacent to the second sidewall spacer (col. 8, lines 56-65)(claim 7).

Additionally, Gardner teaches: a First temperature is lower than a second temperature (col. 7, line 56-col. 8, line 6).

Gardner lacks anticipation only in not explicitly teaching that: 1) after implanting the impurity ions of the first and second conductivity types, performing pre-annealing at a first substrate temperature; and after pre-annealing, performing main activation for impurity ions of the first and second types at a second substrate temperature higher than the first substrate temperature for a treatment period shorter than a period of the pre-annealing (claim 1)

Krivokapic shows a method for improving hot carrier immunity for devices with very shallow junctions. Krivokapic shows a first anneal that is performed for 5-10 seconds, this is followed by a second anneal that is performed for 2-5 seconds (col. 4, line 38-col. 5, line 40). This aids in reducing the very high electric field that can be produced which can lead to hot carrier injection problems (col. 1, lines 35-59).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the method shown in Gardner, of performing a first and second anneal process with the second anneal being shorter in duration than the first, as taught by Krivokapic, with the motivation that Krivokapic teaches that the process aids in reducing the very high electric field that can be produced which can lead to hot carrier injection problems.

7. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (U.S. Patent No. 5,837,572 dated 11/17/1998) in view of Krivokapic et al. (U.S. Patent No. 6,512,273 dated 1/28/2003) as applied to claim 4 above, and further in view of Osanai et al. (U.S. Patent No. 6,777,752 filed 8/31/2001).

Gardner as modified by Krivokapic lacks anticipation only in not explicitly teaching that: 1) the pre-annealing and diffusing the impurity ions of the first conductivity type into the polycrystalline conductive film are preformed by use of any of an infrared lamp, and an electric furnance and hot plate operated by resistance heating (claim 12).

Teaches the use of an electric furnace use to drive in dopants. The electric furnace is heated to 800 to 1000 degrees C depending on the thickness of the gate insulating layer, in order to drive in impurities (col. 45, lines 57-67). This allows for a lower threshold voltage, thus low voltage operation and low power consumption are possible (col. 1, line 62-col. 2, line 5).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the method shown in Gardner as modified by Krivokapic, by using an electric furnace to drive in impurities, as taught by Osanai, with the motivation that, Osanai teaches that a lower threshold voltage allows for low voltage operation and power consumption.

Allowable Subject Matter

8. Claims 9-11 and 13-19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter: the prior art, either singly or in combination fails to anticipate or render obvious, the limitations of:

...wherein the first substrate temperature T_1 (°C) and the treatment period t_{pa} (sec) of the pre-annealing satisfy a relationship represented by a following equation:

$5x10^{-8}exp[2.21x10^4/(T_1+275)] \leq t_{pa} \leq 6x10^{-13}exp[3.74x10^4/(T_1+275)]$, as required by claim 9; and

...performing pre-heating at a third substrate temperature approximately equal to/less than a temperature at the diffusing the impurity ions of the first conductivity type into the polycrystalline conductive film before the main activation, wherein the main activation is performed subsequently to the pre-heating, as required by claim 17.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Walter L. Lindsay, Jr. whose telephone number is (571) 272-1674. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Walter L. Lindsay, Jr.
Examiner
Art Unit 2812

WLL
June 9, 2005